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ABSTRACT

This document lists proposed environmental concepts for the high school education level of achievement. These concepts were developed by the Federal Interagency Committee on Education (FICE) for consideration by students, teachers, and others in the education community. These objectives are intended to cover the learning needed by an individual to understand and to help encourage Federal activities related to environmental quality. The agencies contributing to this list were: The Environmental Protection Agency, the National Park Service, the Forest Service, the Office of Education, the Office of Sea Grants in the Department of Commerce, the National Science Foundation, the Bureau of Land Management, the Energy Research and Development Administration, and the Council on Environmental Quality. The list of learning objectives is designed to cover only the content and not values and skills related to the environment. The list of objectives is organized around three major categories: (1) fundamentals of earth's environment, (2) humans as a part of earth's ecosystems, and (3) harmonizing human needs with ecosystem limits. This list is proposed as a guide for textbook writers, curriculum supervisors, and other educators. (BT)

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PROPOSED LEARNING OBJECTIVES FOR ENVIRONMENTAL EDUCATION

One of the continual problems of environmental education is that there has been no determination on how much of it is enough. No one has really tried to say what an "environmentally literate" person should know.

This is in sharp contrast to the treatment given other subjects in which the target concepts for testing and evaluating a high school graduate are well established. In mathematics, literature and reading, for example, certain knowledge and skill levels are widely accepted. In fact, performance measures such as the Scholastic Aptitude Test are used to measure learning achievement. The situation for environmental learning is considerably more cloudy. Controversies over issues such as outdoor techniques or urban content have taken precedence over any real discussion on what should be learned on environmental subjects during an individual's basic education.

The uncertainty on learning objectives, however, has not caused environmental teaching to cease. Federal expenditures during Fiscal Year 1972 were $24 million and expenditures by volunteer groups, industry plus State and local education agencies, were many times that level.

The difficulty has been, and still is that there is no way to tell when the expenditures and efforts are conveying the intended environmental concepts.

As a partial solution to this problem, the Federal Interagency Committee on Education (FICE)[1] is proposing a group of learning objectives

[1] The Federal Interagency Committee on Education is composed of the senior education and training persons in the major departments and agencies. Through monthly meetings chaired by the Assistant Secretary of Education, the Committee makes policy recommendations on a wide range of education issues.

SE 019 223

for consideration by students, teachers and others in the education community. These objectives are intended to cover the learning needed by an individual to understand and to help encourage Federal activities related to environmental quality.

The agencies contributing to the list were: the Environmental Protection Agency, the National Park Service, the Soil Conservation Service, the Forest Service, the Office of Education, the Office of Sea Grants in the Department of Commerce, the National Science Foundation, the Bureau of Land Management, the Energy research and Development Administration, and the Council on Environmental Quality.

The list of learning objectives is designed to cover only the content and not values and skills related to the environment. There is no attempt to under rate the importance of the latter two items. The effort is rather to start the discussions with cognitive learning (knowledge) objectives.

The list of objectives is organized around three major categories: (1) fundamentals of earth's environment, (2) humans as a part of earth's ecosystems and (3) harmonizing human needs with ecosystem limits. Although the concepts are briefly stated in most cases, their complexity should not be underestimated. For example, the concept of materials cycling and recycling through ecosystems is one which often requires many hours of consideration in the outdoor classroom or laboratory setting before being assimilated by an individual.

The concepts listed in the section on harmonizing human activities with the ecosystems are especially important. There are many different names and versions for this list of techniques. The steps have been

variously known as the scientific method, the systems approach, analytic problem solving and systematic learning.

The formulation provided in this list has been adapted for environmental problem solving. In actual situations some of the nine steps may be combined or omitted.

The last learning objective — on the individual role in environmental quality — should also be stressed. A high level of consumer demand for polluting and resource wasting items in modern society is a fact. However, the environmentally preferred consumer choices could be learned by the school age population at the same time such subjects as traffic safety, fire prevention and personal hygeine are being learned. (Such learning need not have an adverse economic impact, because the demand for clean, resource conserving products would itself be an economic stimulus).

Finally, the list of learning objectives is not intended as the COMPLETE ANSWER. The list is proposed as a guide for textbook writers, curriculum supervisors and other educators. Comments and suggestions for improvement are welcome, and others wishing to formulate an entirely different list of objectives, to compete with this proposed list, are also encouraged to do so. These concepts have not been officially adopted by any group, nor will they be "implemented." The purpose of the list is simply to begin a national discussion on the learning objectives for environmental education.

Comments and questions may be addressed to: Environmental Education Objectives (A-104), Office of Education and Manpower Planning, EPA, Washington, D.C. 20460.

PROPOSED ENVIRONMENTAL CONCEPTS FOR THE

HIGH SCHOOL EDUCATION LEVEL OF ACHIEVEMENT

I. Fundamental concepts about Earth's environment.

A. Earth's environment is a whole.

1. Earth's environment is made up of air, water, and solid material that constitute a complex, totally interrelated life support system called the "ecosphere."

2. The ecosphere is composed of interacting systems called "ecosystems", which are composed of three parts: (a) physical components (climate, rocks, water, etc.); (b) organisms (humans, reptiles, bacteria); and (c) interactions among them (competition, erosion, decomposition, etc.).

3. Earth's ecosystems are finite.

4. All living things have specific roles or "niches" in ecosystems; some are wide, some very narrow.

5. Living things are interdependent with one another and with their physical environment.

6. The functioning (operation) of individual organisms results from interactions of their heredity with their environment.

B. The ecosphere is a dynamic, changing "super-system".

1. Simple ecosystems develop on bare mineral surfaces (water, sand, rock). As ecosystems develop, their living things contribute to and change the character of the system. These changes enable more types of organisms to live in the systems, thus further changing its character, until it reaches a dynamic equilibrium.

2. As ecosystems develop, their niches become more specialized. Changes in systems interact with changes in organisms that result in closer adaptation of organisms to their niche.
3. As ecosystems mature over long periods of time, diversity of organism types increases in them. Individual organisms come and go, but the character of mature systems remains. As ecosystems mature, they become more resilient to disturbances, resulting in greater ecosystem stability.

C. Materials are the substance of ecosystems; energy is their driving force.

1. Materials are continually cycling and recycling in and among ecosystems. Examples are the water cycle, the carbon cycle, the nitrogen cycle, etc.
2. Energy, by contrast, moves linearly through ecosystems. With each conversion, energy loses some of its force, until it is dissipated.
3. Life itself is a chemical process, dependent on the environment for the energy and nutrients needed to sustain it. Energy comes originally from the sun; nutrients from mineral components of the environment.
4. Green plants through photosynthesis, convert inert minerals of Earth and sun's energy into high energy organic compounds that power all life processes. Respiration is used by organisms to release this energy from compounds.
5. Energy and nutrients pass through food webs from primary producers to herbivores to primary carnivores to secondary carnivores, etc., and finally to decay organisms.

D. Each system has an ability, called "carrying capacity", to support given numbers of each species within it. Population numbers fluctuate from time to time, depending on variations in components of systems, but remain relatively stable unless the system is altered in some significant way.

1. Carrying capacity is governed partly by the nature and intensity of limiting factors and partly by the genetic makeup of system organisms.

2. Physical, chemical and biological factors of systems interact in various ways to limit growth, reproduction, and existence of species.

II. Humans are an integral part of Earth's ecosystems, and are entirely dependent on these ecosystems for their life support.

A. Humans are highly adaptable organisms, and have a high capability to mold conditions to their needs.

1. The limiting factors that control ecosystems and their organisms ultimately control human activities.

2. Some limiting factors are specific to humans: level of knowledge and intelligence; accumulation and transmittal of knowledge; level of technological development; type of sociopolitical structure; political limits on access to natural resources; level of economic backing; cultural proclivities.

3. Human technology and social institutions alter limiting factors: For example (a) pollution can harm human health and can reduce the ability of ecosystems to support life; (b) human settlement, and development and use of resources can destroy habitats of

other species; (c) human population can greatly expand and retain its numbers; (d) technology can delay the impact of limiting factors, but not remove them entirely.

B. Humans are more capable of changing how ecosystems operate than any other species. The rapidity and magnitude of changes they can make are often global, immediate and irreversible.

1. The influence of limiting factors can be stretched by human technology but not eliminated by it.
2. The capacity of ecosystems to support life can be maintained, increased or reduced.
3. Most natural systems are self-sustaining; most technologically-developed human systems require subsidies of energy and materials.

C. Standards of living and quality of life are influenced by human adaptability, technological capability and psychological, cultural, historic, economic, political and social values.

III. Human needs and activities must be harmonized with ecosystem requirements.

A. The steps are:

1. Recognizing importance of ecosystem changes.
2. Identifying causes of ecosystem changes.
3. Distinguishing ecosystem changes that can lead to beneficial results from those that can lead to detrimental results.
4. Analyzing and evaluating the effects of feasible policy alternatives on ecosystems, including humans and their economy and society.
5. Arraying alternative action strategies that would maintain and enhance beneficial ecosystem changes and would reduce or stop detrimental ecosystem changes.

6. Weighing alternatives according to a wide variety of environmental, social, political and economic criteria. Such weighing of criteria will vary with the circumstances of society (good times, war, famine, flood, etc.).

7. Adopting a policy and choosing the actions to implement it. Policy adoption occurs at individual through global levels, consciously or unconsciously.

8. Carrying out adopted policy and actions to implement them is the successful completion of the process.

9. Monitoring effects of implemented policies and actions is essential to keeping them adjusted to changing ecosystem needs and human perceptions. This step should cycle thinking and action back to the first step of recognizing ecosystem requirements.

B. Some of the U.S. national policies that can harmonize humans with their environment are:

1. The use of natural resources is to be studied and managed to protect human interests as well as the environment. Resource availability is to be prolonged by careful extraction, processing, use and recycling. Examples: National Environmental Policy Act, Resource Recovery Act, Mineral Leasing Act, etc.

2. Use of renewable resources such as fertile soil, clean water, breathable air, plants and animals are to be enhanced by protecting and conserving them. Examples: Soil Conservation Act, Forest Service Acts, Clean Air Acts, Water Quality Acts, Taylor Grazing Act, etc.

3. Some human activities that endanger resources, ecosystems and human health have prescribed limits and standards for their conduct. Examples: FIF, ERA, Pure Food and Drugs, Ocean Dumping, Atmospheric Test Ban Treaties, etc.

4. Preservation of all biomes and habitat for rare and endangered species, and national historic and scenic sites is to be assured. Examples: National Park Service Act, Wildlife Preservation Acts, Antiquities Act, Marine Mammal Act, Rare and Endangered Species Act, etc.

5. Use of land must employ stewardship principles rather than consumption. Examples: Coastal Zone Management Act, Outer Continental Shelf Acts, Land Use Policy Acts, Industrial Facility Siting Acts, etc.

6. Critical factors in ecosystems, in human health, and in property will be monitored to establish and assure safe limits for various components. Examples: Atomic Energy Development Acts, Non-Nuclear Energy Research and Development Act, etc.

C. Some issues awaiting the formulation of national policy are:

1. Strip mine land rehabilitation.
2. Land use.
3. Toxic substances.
4. Population control.
5. Industrial plant siting.
6. Materials conservation and recycling.
7. Ecosystem research
8. Strategic Arms Limitation Talks

D. Individuals, through their actions and choices can minimize their own

burden on the biosphere and harmonize their existence with the environment.

1. Pollution control and resource management have an individual component of self restraint and responsibility.
2. Environmentally preferable consumer choices can be identified and practiced by the individual.

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